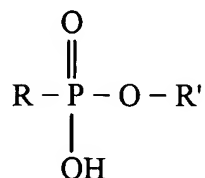


What is claimed is:

1. A method of treating a subterranean formation comprising:  
providing a gelled liquid hydrocarbon treatment fluid comprising a liquid hydrocarbon and a gelling agent that comprises a polyvalent metal salt of an organophosphonic acid ester or a polyvalent metal salt of an organophosphinic acid, and  
treating the subterranean formation with the gelled liquid hydrocarbon treatment fluid.
2. The method of claim 1 wherein the gelled liquid hydrocarbon treatment fluid comprises water and/or a base.
3. The method of claim 1 wherein the liquid hydrocarbon comprises an  $\alpha$ -olefin, an internal olefin, an alkane, an aromatic solvent, a cycloalkane, liquefied petroleum gas, kerosene, diesel oil, gas oil, fuel oil, a petroleum distillate, a crude oil mixture, or a mixture thereof.
4. The method of claim 1 wherein the liquid hydrocarbon is designed for use with CO<sub>2</sub>.
5. The method of claim 1 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an alkali metal or an ammonium salt of the organophosphonic acid ester.
6. The method of claim 1 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an organophosphonic acid dialkyl ester.
7. The method of claim 1 wherein the polyvalent metal salt of an organophosphonic acid ester is formed from the reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphonic acid ester, the organophosphonic acid ester having the formula:



wherein R or R' comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl,

arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R or R' comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

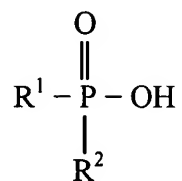
8. The method of claim 7 wherein the polyvalent metal ions comprise aluminum ions, gallium ions, lanthanum ions, ruthenium ions, iron ions, or lanthanide rare earth series ions.

9. The method of claim 7 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

10. The method of claim 7 wherein the activator composition comprises a ferric iron salt, aluminum chloride, sodium aluminate, or aluminum isopropoxide.

11. The method of claim 1 wherein the polyvalent metal salt of an organophosphinic acid is formed by a metathesis reaction comprising an organophosphinic acid alkyl ester.

12. The method of claim 1 wherein the polyvalent metal salt of an organophosphinic acid is formed from a reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphinic acid, the organophosphinic acid having the formula:



wherein R<sup>1</sup> or R<sup>2</sup> comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl, arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R<sup>1</sup> or R<sup>2</sup> comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

13. The method of claim 12 wherein the source of polyvalent metal ions comprises aluminum ions, gallium ions, lanthanum ions, ruthenium ions, iron ions, or lanthanide rare earth series ions.

14. The method of claim 12 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

15. The method of claim 1 wherein the gelled liquid hydrocarbon treatment fluid comprises a surfactant.

16. The method of claim 15 wherein the surfactant comprises imidazoline, a fatty acid soap, a fatty acid, dioctyl sulphosuccinate, sodium alkyl benzene sulphonate, a fatty acid ester, a fatty acid alkanolamide, or an amido betaine.

17. The method of claim 15 wherein the surfactant is present in the gelled liquid hydrocarbon treatment fluid in an amount in the range of from about 0.1% to about 10% based on the gelling agent.

18. The method of claim 1 wherein the gelled liquid hydrocarbon treatment fluid comprises an enhancer.

19. The method of claim 18 wherein the enhancer provides at least some alkalinity to the gelled liquid hydrocarbon treatment fluid.

20. The method of claim 18 wherein the enhancer has the general formula  $C_nH_mO_xN_y$ , wherein n is from about 1 to about 50, m is from about 0 to about the number necessary to satisfy the valence of the enhancer, x is from about 1 to about 10, and y is from about 0 to about 10.

21. The method of claim 18 wherein the enhancer comprises an ethoxylated amine, triethanolamine, *N,N*-dibutyl ethanol amine, an oxyalkylated di- $C_2$ - $C_8$ -alkyl amine, *N,N*-di-loweralkyl fatty amine, an oxyalkylated fatty amine, monoammonium citrate, bis(hydroxyethyl) tallowamine, ethoxylated dehydroabietylamine, or a mixture thereof.

22. The method of claim 1 wherein treating the subterranean formation involves fracturing a portion of the subterranean formation.

23. The method of claim 22 wherein the gelled liquid hydrocarbon treatment fluid comprises proppant.

24. The method of claim 1 wherein treating the subterranean formation involves providing sand control to at least a portion of the subterranean formation.

25. The method of claim 24 wherein the gelled liquid hydrocarbon treatment fluid comprises gravel.

26. The method of claim 23 or 25 wherein the proppant or gravel comprise nut shells, resin-coated nut shells, graded sand, resin-coated sand, sintered bauxite, particulate ceramic materials, glass beads, or particulate polymeric materials.

27. The method of claim 1 wherein the gelled liquid hydrocarbon treatment fluid comprises water, the water being present in an amount of at least about 0.05% by the total treatment fluid volume.

28. The method of claim 1 wherein the gelled liquid hydrocarbon treatment fluid further comprises a breaker, the breaker being present in an amount sufficient to reduce the viscosity of the gelled liquid hydrocarbon treatment fluid at a desired time.

29. The method of claim 28 wherein the breaker comprises a delayed gel breaker.

30. The method of claim 29 wherein the delayed gel breaker comprises an encapsulated delayed gel breaker.

31. The method of claim 29 wherein the delayed gel breaker is present in an amount in the range of from about 0.01% to about 3% w/v.

32. The method of claim 28 wherein the breaker comprises hard burned magnesium oxide, an alkali metal carbonate, alkali metal bicarbonate, alkali metal acetate, an alkaline earth metal oxides, an alkali metal hydroxide, an amine, or a weak acid.

33. The method of claim 28 wherein the breaker comprises a reducing agent that is capable of reducing ferric iron to ferrous iron.

34. The method of claim 33 wherein the reducing agent comprises stannous chloride, thioglycolic acid, hydrazine sulfate, sodium diethyldithiocarbamate, sodium dimethyldithiocarbamate, sodium hypophosphite, potassium iodide, hydroxylamine hydrochloride, 2-mercaptoethanol, ascorbic acid, sodium thiosulfate, sodium dithionite, or sodium sulfite.

35. The method of claim 28 wherein the breaker is present in an amount of 0.01% to about 3% of the volume of the treatment fluid.

36. The method of claim 1 wherein the treating the subterranean formation involves using the gelled liquid hydrocarbon treatment fluid to provide a plugging agent to a portion of the subterranean formation or a portion of a well bore penetrating the subterranean formation.

37. The method of claim 1 wherein treating the subterranean formation involves using the gelled liquid hydrocarbon treatment fluid as a well bore cleanup fluid.

38. The method of claim 1 wherein treating the subterranean formation involves using the gelled liquid hydrocarbon treatment fluid to perform a viscous sweep of a portion of the subterranean formation or a portion of a well bore penetrating the subterranean formation.

39. The method of claim 1 wherein treating the subterranean formation involves insulating a portion of the subterranean formation, a portion of a well bore penetrating the subterranean formation, or a tubing placed in a well bore penetrating the subterranean formation.

40. The method of claim 1 further comprising the step of preparing the gelled liquid hydrocarbon treatment fluid at the location of the subterranean formation.

41. The method of claim 1 further comprising the step of preparing the gelled liquid hydrocarbon treatment fluid at a location away from the subterranean formation and transporting the gelled liquid hydrocarbon treatment fluid to the subterranean formation.

42. A method of fracturing a portion of a subterranean formation comprising:  
providing a gelled liquid hydrocarbon fracturing fluid comprising a gelling agent that comprises a polyvalent metal salt of an organophosphonic acid ester or a polyvalent metal salt of an organophosphinic acid, and

contacting the portion of the subterranean formation with the gelled liquid hydrocarbon fracturing fluid under conditions effective to create or enhance at least one fracture in the subterranean formation.

43. The method of claim 42 wherein the gelled liquid hydrocarbon fracturing fluid comprises water and/or a base.

44. The method of claim 42 wherein the gelled liquid hydrocarbon fracturing fluid comprises an  $\alpha$ -olefin, an internal olefin, an alkane, an aromatic solvent, a cycloalkane, liquefied petroleum gas, kerosene, diesel oil, gas oil, fuel oil, a petroleum distillate, a crude oil mixture, or a mixture thereof.

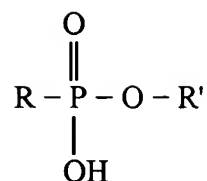
45. The method of claim 42 wherein the polyvalent metal salt of an organophosphonic acid ester or the polyvalent metal salt of an organophosphinic acid is present in an amount in the range of from about 0.1% to about 10% w/v.

46. The method of claim 42 wherein the polyvalent metal salt of an organophosphonic acid ester or the polyvalent metal salt of an organophosphinic acid is present in an amount in the range of from about 0.2% to about 5% w/v.

47. The method of claim 42 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an alkali metal or an ammonium salt of the organophosphonic acid ester.

48. The method of claim 42 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an organophosphonic acid dialkyl ester.

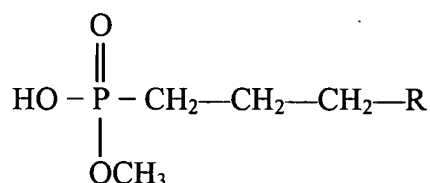
49. The method of claim 42 wherein the polyvalent metal salt of an organophosphonic acid ester is formed from the reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphonic acid ester, the organophosphonic acid ester having the formula:



wherein R or R' comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl, arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R or R' comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

50. The method of claim 49 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

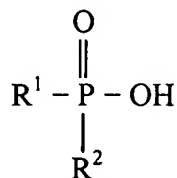
51. The method of claim 42 wherein the polyvalent metal salt of an organophosphonic acid ester is formed from the reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphonic acid ester, the organophosphonic acid ester having the formula:



where R represents a hydrocarbon group having the general formula  $\text{C}_n\text{H}_{2n+1}$ , where n is from about 3 to about 21.

52. The method of claim 42 wherein the polyvalent metal salt of an organophosphinic acid is formed by a metathesis reaction comprising an organophosphinic acid alkyl ester.

53. The method of claim 42 wherein the polyvalent metal salt of an organophosphinic acid is formed from a reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphinic acid, the organophosphinic acid having the formula:

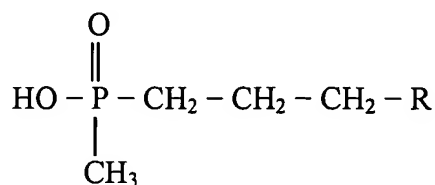


wherein  $\text{R}^1$  or  $\text{R}^2$  comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl,

arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R<sup>1</sup> or R<sup>2</sup> comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

54. The method of claim 53 wherein the source of polyvalent metal ions comprise ions having a +3 oxidation state.

55. The method of claim 42 wherein the polyvalent metal salt of an organophosphinic acid is formed from a reaction of an activator composition comprising a source of polyvalent metal ions and an organophosphinic acid, the organophosphinic acid having the formula:



where R represents a linear or branched alkyl chain having the general formula C<sub>n</sub>H<sub>2n+1</sub>, where n is from about 3 to about 21.

56. The method of claim 42 wherein the gelled liquid hydrocarbon treatment fluid comprises an enhancer.

57. The method of claim 42 wherein the gelled liquid hydrocarbon treatment fluid comprises a surfactant.

58. The method of claim 56 has the general formula C<sub>n</sub>H<sub>m</sub>O<sub>x</sub>N<sub>y</sub>, wherein n is about 1 to about 50, m is about 0 to about the number necessary to satisfy the valence of the enhancer, x is about 1 to about 10, and y is about 0 to about 10.

59. The method of claim 42 wherein the gelled liquid hydrocarbon fracturing fluid comprises proppant.

60. The method of claim 58 wherein the proppant is present in an amount in the range of from about 1 to about 32 pounds of proppant per gallon of treatment fluid.

61. The method of claim 59 wherein the proppant comprises nut shells, resin coated nut shells, graded sand, resin-coated sand, sintered bauxite, particulate ceramic materials, glass beads, or particulate polymeric materials.

62. The method of claim 42 wherein the gelled liquid hydrocarbon fracturing fluid further comprises a breaker, the breaker being present in an amount sufficient to reduce the viscosity of the gelled liquid hydrocarbon treatment fluid at a desired time.



63. The method of claim 62 wherein the breaker is present in an amount of about 0.01% to about 3% w/v.

64. A method of providing sand control to a portion of a subterranean formation comprising:

providing a gelled liquid hydrocarbon gravel pack fluid that comprises gravel particulates and a gelling agent that comprises a polyvalent metal salt of an organophosphonic acid ester or a polyvalent metal salt of an organophosphinic acid; and  
contacting the portion of the subterranean formation with the gelled liquid hydrocarbon gravel pack fluid so as to form a gravel pack near the portion of the subterranean formation.

65. The method of claim 64 wherein the gelled liquid hydrocarbon gravel pack fluid comprises water and/or a base.

66. The method of claim 64 wherein the gelled liquid hydrocarbon gravel pack fluid comprises an  $\alpha$ -olefin, an internal olefin, an alkane, an aromatic solvent, a cycloalkane, liquefied petroleum gas, kerosene, diesel oil, gas oil, fuel oil, a petroleum distillate, a crude oil mixture, or a mixture thereof.

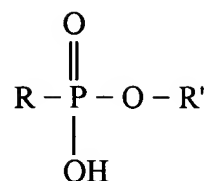
67. The method of claim 64 wherein the polyvalent metal salt of an organophosphonic acid ester or the polyvalent metal salt of an organophosphinic acid are present in an amount in the range of from about 0.1% to about 10% w/v.

68. The method of claim 64 wherein the polyvalent metal salt of an organophosphonic acid ester or the polyvalent metal salt of an organophosphinic acid are present in an amount in the range of from about 0.1% to about 5% w/v.

69. The method of claim 64 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an alkali metal or an ammonium salt of the organophosphonic acid ester.

70. The method of claim 64 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an organophosphonic acid dialkyl ester.

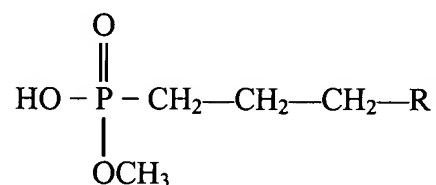
71. The method of claim 64 wherein the polyvalent metal salt of an organophosphonic acid ester is formed from the reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphonic acid ester, the organophosphonic acid ester having the formula:



wherein R or R' comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl, arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R or R' comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

72. The method of claim 71 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

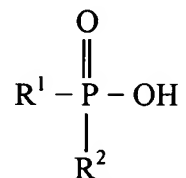
73. The method of claim 64 wherein the polyvalent metal salt of an organophosphonic acid ester is formed from the reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphonic acid ester, the organophosphonic acid ester having the formula:



where R represents a hydrocarbon group having the general formula  $\text{C}_n\text{H}_{2n+1}$ , where n is from about 3 to about 21.

74. The method of claim 64 wherein the polyvalent metal salt of an organophosphonic acid is formed by a metathesis reaction comprising an organophosphonic acid alkyl ester.

75. The method of claim 64 wherein the polyvalent metal salt of an organophosphonic acid is formed from a reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphonic acid, the organophosphonic acid having the formula:

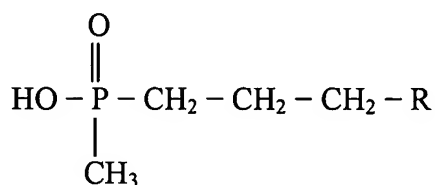


wherein  $\text{R}^1$  or  $\text{R}^2$  comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl,

arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R<sup>1</sup> or R<sup>2</sup> comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

76. The method of claim 75 wherein the source of polyvalent metal ions comprise ions having a +3 oxidation state.

77. The method of claim 64 wherein the polyvalent metal salt of an organophosphinic acid is formed from a reaction of an activator composition comprising a source of polyvalent metal ions and an organophosphinic acid, the organophosphinic acid having the formula:



where R represents a linear or branched alkyl chain having the general formula C<sub>n</sub>H<sub>2n+1</sub>, where n is from about 3 to about 21.

78. The method of claim 64 wherein the gelled liquid hydrocarbon gravel pack fluid comprises an enhancer.

79. The method of claim 64 wherein the gelled liquid hydrocarbon gravel pack fluid comprises a surfactant.

80. The method of claim 78 wherein the enhancer has the general formula C<sub>n</sub>H<sub>m</sub>O<sub>x</sub>N<sub>y</sub>, wherein n is about 1 to about 50, m is about 0 to about the number necessary to satisfy the valence, x is about 1 to about 10, and y is about 0 to about 10.

81. The method of claim 64 wherein the gravel is present in an amount in the range of from about 1 to about 32 pounds of gravel per gallon of treatment fluid.

82. The method of claim 64 wherein the gelled liquid hydrocarbon gravel pack fluid further comprises a breaker, the breaker being present in an amount sufficient to reduce the viscosity of the gelled liquid hydrocarbon treatment fluid at a desired time.

83. The method of claim 82 wherein the breaker is present in an amount of about 0.01% to about 3% w/v.

84. A method of preparing a gelled liquid hydrocarbon treatment fluid comprising adding polyvalent metal organophosphonic acid ester salt particulates or polyvalent organophosphonic acid salt particulates to a liquid hydrocarbon to form a gelled liquid hydrocarbon treatment fluid.

85. The method of claim 84 wherein the polyvalent metal organophosphonic acid ester salt particulates or the polyvalent organophosphonic acid salt particulates comprise polyvalent metal salt flakes.

86. The method of claim 84 wherein the liquid hydrocarbon is pre-gelled or partially gelled before addition of the polyvalent metal organophosphonic acid ester salt particulates or the polyvalent organophosphonic acid salt particulates.

87. The method of claim 84 wherein the polyvalent metal organophosphonic acid ester salt particulates or the polyvalent organophosphonic acid salt particulates are added to the liquid hydrocarbon at a subterranean well site.

88. The method of claim 84 further comprising adding a base to the liquid hydrocarbon.

89. The method of claim 84 further comprising adding water and/or a base to the gelled liquid hydrocarbon treatment fluid.

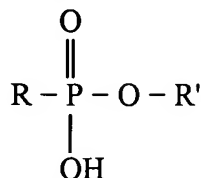
90. The method of claim 84 wherein the liquid hydrocarbon comprises an  $\alpha$ -olefin, an internal olefin, an alkane, an aromatic solvent, a cycloalkane, liquefied petroleum gas, kerosene, diesel oil, gas oil, fuel oil, a petroleum distillate, a crude oil mixture, or a mixture thereof.

91. The method of claim 84 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an alkali metal or an ammonium salt of the organophosphonic acid ester.

92. The method of claim 84 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an organophosphonic acid dialkyl ester.

93. The method of claim 84 wherein the polyvalent metal salt of an organophosphonic acid ester is formed from the reaction of an activator composition that

comprises a source of polyvalent metal ions and an organophosphonic acid ester, the organophosphonic acid ester having the formula:

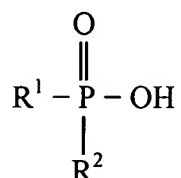


wherein R or R' comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl, arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R or R' comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

94. The method of claim 93 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

95. The method of claim 84 wherein the polyvalent metal salt of an organophosphonic acid is formed by a metathesis reaction comprising an organophosphonic acid alkyl ester.

96. The method of claim 84 wherein the polyvalent metal salt of an organophosphonic acid is formed from a reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphonic acid, the organophosphonic acid having the formula:



wherein R<sup>1</sup> or R<sup>2</sup> comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl, arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R<sup>1</sup> or R<sup>2</sup> comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

97. The method of claim 96 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

98. The method of claim 84 further comprising adding a surfactant to the gelled liquid hydrocarbon treatment fluid.

99. The method of claim 84 further comprising adding an enhancer to the gelled liquid hydrocarbon treatment fluid.

100. The method of claim 99 wherein the enhancer has the general formula  $C_nH_mO_xN_y$ , wherein n is about 1 to about 50, m is about 0 to about the number necessary to satisfy the valence of the enhancer, x is about 1 to about 10, and y is about 0 to about 10.

101. A method of preparing a gelled liquid hydrocarbon treatment fluid comprising:
- forming an initial liquid hydrocarbon gel that comprises a liquid hydrocarbon and a first gelling agent that comprises a polyvalent metal salt of an organophosphonic acid ester or a polyvalent metal salt of an organophosphinic acid; and
  - adding a second gelling agent to the initial liquid hydrocarbon gel at a desired time to form a viscous gel.
102. The method of claim 101 wherein the second gelling agent comprises a polyvalent metal salt of an organophosphonic acid ester or a polyvalent metal salt of an organophosphinic acid.
103. The method of claim 101 wherein the second gelling agent is added to the initial liquid hydrocarbon gel as the initial liquid hydrocarbon gel is being pumped into a well bore penetrating a subterranean formation.

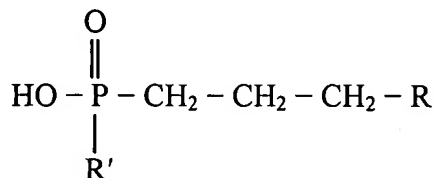


104. A method of preparing a gelled liquid hydrocarbon treatment fluid comprising:

preparing a concentrated gelled liquid hydrocarbon fluid; and  
diluting the concentrated gelled liquid hydrocarbon fluid with a hydrocarbon to prepare a gelled liquid hydrocarbon treatment fluid.

105. The method of claim 104 wherein preparing the concentrated gelled liquid hydrocarbon fluid occurs at a different location than a location at which the gelled liquid hydrocarbon treatment fluid will be used.

106. A method of preparing a gelled liquid hydrocarbon fluid comprising:  
adding an organophosphinic acid having the formula:



where R represents a hydrocarbon group having the general formula  $\text{C}_n\text{H}_{2n+1}$ , where n is from about 3 to about 21 and R' is either methyl or ethyl;

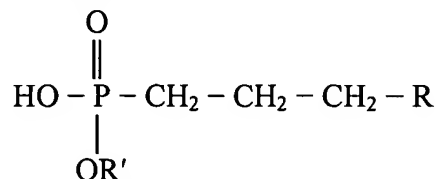
adding an activator composition comprising a source of polyvalent metal ions that react with the organophosphinic acid to form a suitable polyvalent metal salt;  
and

allowing the liquid hydrocarbon to gel.

107. The method of claim 106 wherein the liquid hydrocarbon comprises an  $\alpha$ -olefin, an internal olefin, an alkane, an aromatic solvent, a cycloalkane, liquefied petroleum gas, kerosene, diesel oil, gas oil, fuel oil, a petroleum distillate, a crude oil mixture, or a mixture thereof.

108. The method of claim 106 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

109. A method of preparing a gelled liquid hydrocarbon fluid comprising:  
adding an organophosphonic acid ester having the formula:



where R represents a hydrocarbon group having the general formula  $\text{C}_n\text{H}_{2n+1}$ , where n is from about 3 to about 21 and R' is either methyl or ethyl;

adding an activator composition comprising a source of polyvalent metal ions that react with the organophosphonic acid ester to form a suitable polyvalent metal salt; and

allowing the liquid hydrocarbon to gel.

110. The method of claim 109 wherein the liquid hydrocarbon comprises an  $\alpha$ -olefin, an internal olefin, an alkane, an aromatic solvent, a cycloalkane, liquefied petroleum gas, kerosene, diesel oil, gas oil, fuel oil, a petroleum distillate, a crude oil mixture, or a mixture thereof.

111. The method of claim 109 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

112. A gelled liquid hydrocarbon treatment fluid comprising:  
a liquid hydrocarbon; and  
a gelling agent that comprises a polyvalent metal salt of a phosphonic acid ester or a polyvalent metal salt of an organophosphonic acid.

113. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the gelled liquid hydrocarbon treatment fluid comprises water and/or a base.

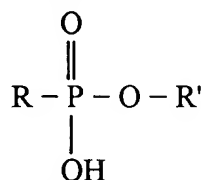
114. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the liquid hydrocarbon comprises an  $\alpha$ -olefin, an internal olefin, an alkane, an aromatic solvent, a cycloalkane, liquefied petroleum gas, kerosene, diesel oil, gas oil, fuel oil, a petroleum distillate, a crude oil mixture, or a mixture thereof.

115. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the liquid hydrocarbon is designed for use with CO<sub>2</sub>.

116. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an alkali metal or an ammonium salt of the organophosphonic acid ester.

117. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the polyvalent metal salt of an organophosphonic acid ester is formed by a metathesis reaction comprising an organophosphonic acid dialkyl ester.

118. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the polyvalent metal salt of an organophosphonic acid ester is formed from the reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphonic acid ester, the organophosphonic acid ester having the formula:



wherein R or R' comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl, arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R or R' comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

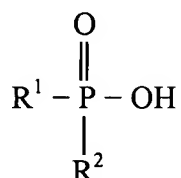
119. The gelled liquid hydrocarbon treatment fluid of claim 118 wherein the polyvalent metal ions comprise aluminum ions, gallium ions, lanthanum ions, ruthenium ions, iron ions, or lanthanide rare earth series ions.

120. The gelled liquid hydrocarbon treatment fluid of claim 118 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

121. The gelled liquid hydrocarbon treatment fluid of claim 118 wherein the activator composition comprises a ferric iron salt, aluminum chloride, sodium aluminate, or aluminum isopropoxide.

122. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the polyvalent metal salt of an organophosphinic acid is formed by a metathesis reaction comprising an organophosphinic acid alkyl ester.

123. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the polyvalent metal salt of an organophosphinic acid is formed from a reaction of an activator composition that comprises a source of polyvalent metal ions and an organophosphinic acid, the organophosphinic acid having the formula:



wherein R<sup>1</sup> or R<sup>2</sup> comprises a hydrocarbon group having about 1 to about 30 carbon atoms that, for example, may comprise a linear or branched alkyl, alkenyl, aryl, alkylaryl, arylalkyl, cycloalkyl, alkyl ether, aryl ether, alkyl aryl ether, or a mixture thereof; and R<sup>1</sup> or R<sup>2</sup> comprises a hydrocarbon group having from about 1 to about 6 carbon atoms.

124. The gelled liquid hydrocarbon treatment fluid of claim 123 wherein the source of polyvalent metal ions comprises aluminum ions, gallium ions, lanthanum ions, ruthenium ions, iron ions, or lanthanide rare earth series ions.

125. The gelled liquid hydrocarbon treatment fluid of claim 123 wherein the polyvalent metal ions comprise ions having a +3 oxidation state.

126. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the gelled liquid hydrocarbon treatment fluid comprises a surfactant.

127. The gelled liquid hydrocarbon treatment fluid of claim 126 wherein the surfactant comprises imidazoline, a fatty acid soap, a fatty acid, dioctyl sulphosuccinate,

sodium alkyl benzene sulphonate, a fatty acid ester, a fatty acid alkanolamide, or an amido betaine.

128. The gelled liquid hydrocarbon treatment fluid of claim 126 wherein the surfactant is present in the gelled liquid hydrocarbon treatment fluid in an amount in the range of from about 0.1% to about 10% based on the gelling agent.

129. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the gelled liquid hydrocarbon treatment fluid comprises an enhancer.

130. The gelled liquid hydrocarbon treatment fluid of claim 129 wherein the enhancer provides at least some alkalinity to the gelled liquid hydrocarbon treatment fluid.

131. The gelled liquid hydrocarbon treatment fluid of claim 129 wherein the enhancer has the general formula  $C_nH_mO_xN_y$ , wherein n is about 1 to about 50, m is about 0 to about the number necessary to satisfy the valence of the enhancer, x is about 1 to about 10, and y is about 0 to about 10.

132. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the gelled liquid hydrocarbon treatment fluid comprises particulates.

133. The gelled liquid hydrocarbon treatment fluid of claim 132 wherein the particulates comprise nut shells, resin-coated nut shells, graded sand, resin-coated sand, sintered bauxite, particulate ceramic materials, glass beads, or particulate polymeric materials.

134. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the gelled liquid hydrocarbon treatment fluid comprises water, the water being present in an amount of at least about 0.05% by the total treatment fluid volume.

135. The gelled liquid hydrocarbon treatment fluid of claim 112 wherein the gelled liquid hydrocarbon treatment fluid further comprises a breaker, the breaker being present in an amount sufficient to reduce the viscosity of the gelled liquid hydrocarbon treatment fluid at a desired time.

136. The gelled liquid hydrocarbon treatment fluid of claim 135 wherein the breaker comprises a delayed gel breaker.

137. The gelled liquid hydrocarbon treatment fluid of claim 135 wherein the delayed gel breaker comprises an encapsulated delayed gel breaker.

138. The gelled liquid hydrocarbon treatment fluid of claim 136 wherein the delayed gel breaker is present in an amount in the range of from about 0.01% to about 3% w/v.

139. The gelled liquid hydrocarbon treatment fluid of claim 135 wherein the breaker comprises hard-burned magnesium oxide, an alkali metal carbonate, alkali metal bicarbonate, alkali metal acetate, an alkaline earth metal oxide, an alkali metal hydroxide, an amine, or a weak acid.

140. The gelled liquid hydrocarbon treatment fluid of claim 135 wherein the breaker comprises a reducing agent that is capable of reducing ferric iron to ferrous iron.

141. The gelled liquid hydrocarbon treatment fluid of claim 140 wherein the reducing agent comprises stannous chloride, thioglycolic acid, hydrazine sulfate, sodium diethyldithiocarbamate, sodium dimethyldithiocarbamate, sodium hypophosphite, potassium iodide, hydroxylamine hydrochloride, 2-mercaptoethanol, ascorbic acid, sodium thiosulfate, sodium dithionite, or sodium sulfite.

142. The gelled liquid hydrocarbon treatment fluid of claim 135 wherein the breaker is present in an amount of 0.01% to about 3% of the volume of the treatment fluid.